ISWS/BUL-60(31)/84

BULLETIN 60-31

STATE OF ILLINOIS

DEPARTMENT OF ENERGY AND NATURAL RESOURCES

Public Groundwater Supplies in Wabash County

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ILLINOIS STATE WATER SURVEY

CHAMPAIGN

1984

Funds derived from University of Illinois administered grants and contracts were used to produce this report.

PUBLIC GROUNDWATER SUPPLIES IN WABASH COUNTY

by Dorothy M. Woller and Robert D. Olson

Introduction

This publication presents all available information on production wells used for public groundwater supplies in Wabash County. Bulletin 60, which is divided into separate publications by county, supersedes Bulletin 40 and its Supplements 1 and 2.

This report includes separate descriptions for 5 groundwater supply systems furnishing water to 6 municipalities. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. An explanation of the format used in the descriptions is also given.

Acknowledgments. This report was prepared under the general direction of Stanley A. Changnon, Jr., Chief of the Illinois State Water Survey, and James P. Gibb, Head of the Groundwater Section. The chemical analyses, unless otherwise stated, were made by personnel of the Water Survey Analytical Chemistry Laboratory Unit under the supervision of James C. Whitney. The analyses made by personnel of the Illinois Environmental Protection Agency were under the supervision of Ira M. Markwood. M. L. Sargent and R. D. Brower of the Illinois State Geological Survey reviewed the geological information in the manuscript. Grateful acknowledgment also is given to consulting engineers, well drillers, water superintendents, and municipal officials who have provided valuable information used in this report.

Groundwater Geology

The geology of Wabash County is described generally in Illinois State Geological Survey Circular 212, "Groundwater Geology in Southern Illinois". The following brief discussion of geologic conditions in the county is taken largely from that publication. For a more detailed definition of the geology in this portion of the state, the reader is referred to the State Geological Survey, which is located at the University of Illinois, Champaign.

Glacial drift deposits, some alluvial deposits, and a thin, widespread cover of loess form the present-day land surface in Wabash County. These unconsolidated deposits vary greatly in thickness and water-yielding character throughout the county. Sand and gravel deposits up to 70 ft thick are the principal components of the glacial outwash and alluvium in the Wabash River Valley south of Mt. Carmel. These permeable deposits are capable of yielding large quantities of water to individual wells. Local municipal wells finished in these deposits have attained yields of 100 to 500 gpm. On the west border of the county in the bottomlands of Bonpas Creek and along the Wabash River northeast of Mt. Carmel, scattered sand and gravel deposits may be present that are suitable for developing moderate quantities of water (100 gpm or less). On the uplands between the Wabash and Bonpas valleys, the unconsolidated deposits are thin (50 ft or less) and lack significant sand and gravel deposits for the successful development of drilled wells.

Beneath the unconsolidated deposits, rocks of the Pennsylvanian System form the bedrock surface. Exposures of bedrock (outcrops) are common in the upland areas and along the bluffs associated with the major stream valleys. The Pennsylvanian rocks consist principally of shale with only a few thin beds of water-yielding sandstone, limestone, or coal. These units normally yield only small quantities of water to individual wells, with yields ranging from less than 10 gpm at most locations to over 35 gpm from localized sandstone units. One municipal supply in the northeast and another in the south central part of the county rely on wells tapping 50- to 80-ft-thick beds of

Pennsylvanian sandstone for their supply. The low yielding Pennsylvanian rocks have been developed for domestic water supplies by wells scattered in other areas within the county. Two faults of small to moderate displacement, generally trending northeast-southwest, are located in the east-central and southeast portions of the county. The mineral content of groundwater from the unconsolidated deposits and the shallow bedrock ranges from low to moderate throughout most of the county, but at depths of about 175 to 325 ft, it becomes too highly mineralized for water supply use. Locally, brine discharge from oil field operations and improperly abandoned oil wells has contaminated portions of the sand and gravel deposits in the larger stream valleys.

Groundwater Development for Public Use

Groundwater is used as a source for 5 public water supply systems furnishing water to Albion (and Browns), Allendale, Bellmont, Grayville, and Keensburg. The locations of these supplies are shown in figure 1.

Sand and gravel deposits in the unconsolidated materials above bedrock in Wabash County are tapped as a source of water for Albion (and Browns), Grayville, and Keensburg. There are presently 8 production and standby wells, ranging in depth from 42.8 to 81.3 ft, finished in the sand and gravel deposits. Their reported yields range from 100 to 502 gpm depending upon the type of well constructed and the permeability, thickness, and areal extent of the sand and gravel aquifer tapped by each well. Production from these wells in 1981 was estimated to be about 718,840 gpd. Past and present analyses of water from these wells indicate that the iron content ranges from 0.0 to 1.8 mg/l, and the hardness from 277 to 383 mg/l. Water for Albion is prechlorinated, treated with polyphosphate to keep iron in solution, fluoridated, zeolite softened, and postchlorinated. Water at Grayville is fluoridated and chlorinated. Water at Keensburg is aerated, filtered, fluoridated, and chlorinated.

Pennsylvanian sandstone is used as a source of water for Allendale and Bellmont. Presently there are 7 production and standby wells ranging in depth from 170 to 346 ft which are open to Pennsylvanian sandstone. The wells are pumped at rates of about 7 to 36 gpm. Withdrawal from the wells was estimated to be about 65,840 gpd in 1981. Past and present analyses of water from these wells indicate that the iron content ranges from 0.0 to 0.71 mg/1, and the hardness from 2 to 310 mg/1. Water for Allendale is chlorinated and fluoridated. Water at Bellmont is chlorinated.

Total public water supply pumpage in Wabash County for 1981 was about 785,000 gpd. Estimated pumpage from municipal wells tapping sand and gravel was about 92 percent of this total, and the remaining 8 percent was from wells obtaining water from Pennsylvanian sandstone. The water-bearing sand and gravel deposits associated with the bottomlands of the Wabash River are capable of ultimate yields larger than presently withdrawn.

Format

In this publication the descriptions of public groundwater supply systems are presented in alphabetical order by place name.

The U. S. Census of population for 1980 for incorporated communities is given at the beginning of each description.

The number of services and quantity of water distributed at each supply are given where available for the earliest and the latest reported values.

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses.*

When available, sample study logs prepared by the Illinois State Geological Survey are presented. When these are not available, drillers logs are used as reported. Commonly used drillers terms such as clay, silt, or pebbly clay generally are synonymous with the glacial tills tabulated by the State Geological Survey. When the bedrock aquifers tapped by a well are described, the drillers log and casing record are used to determine the geohydrologic units open to the hole.

The screen sizes reported in this publication are for continuous slot type screens. Slot sizes indicate the width of the slot openings in thousandths of an inch. For example, a 20 slot screen has slot openings 0.020 in. wide and a 100 slot screen has slots 0.100 in. wide.

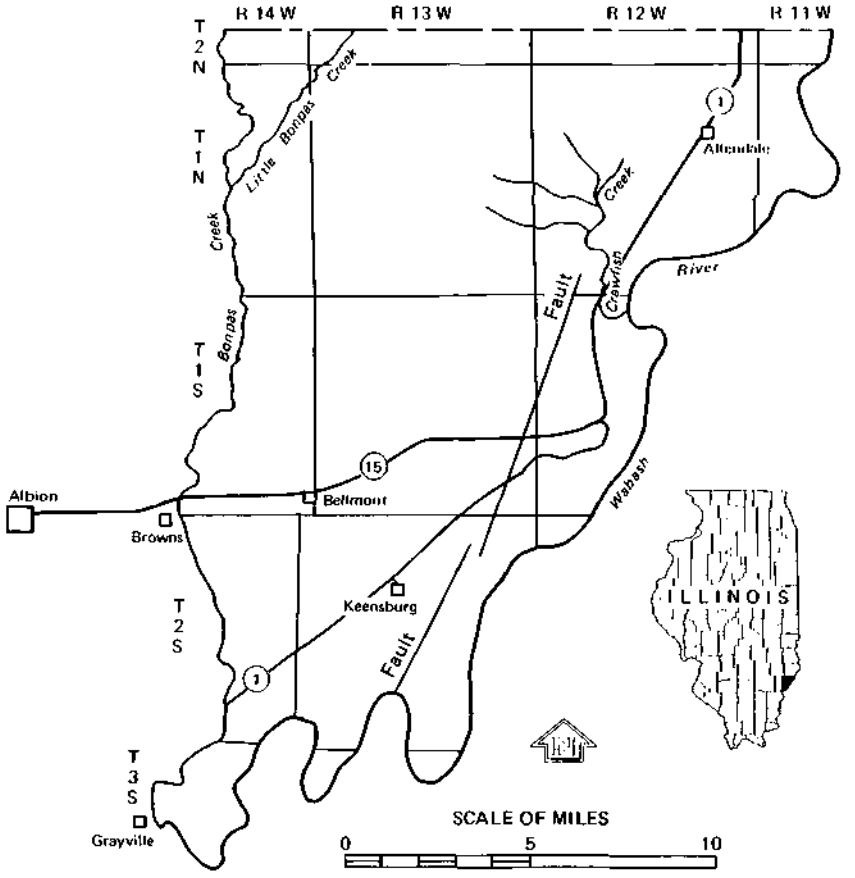

Figure 1. Location of public groundwater supplies in Wabash County

Abbreviations Used

ft.	foot (feet)
gal.	gallons(s)
gpd.	gallons per day
gpm.	gallons per minute
bp.	horsepower
hr.	hour(s)
HCl.	hydrochloric acid
HTH.	high test hypochlorite
ID.	inside diameter
in.	inch(es)
Lab.	laboratory
me/l.	milliequivalents per liter
mg/l.	milligrams per liter
min.	minute(s)
No.(s).	numbers)
OD.	outside diameter
pc/l.	picocuries per liter
R.	range
rpm.	revolutions per minute
T.	township
TDH.	total dynamic head

ALBION

The city of Albion (2285) installed a public water supply in 1926. Although this city is located in Edwards County, water is obtained from wells located 0.6 mile northeast of Grayville in the Wabash River bottoms in Wabash County. Three wells (Nos. 1, 2, and 4) are in use and another well (No. 3) is available for emergency use. Water from this supply is also furnished to the village of Browns. In 1954, the estimated average and maximum pumpages were 128,000 and 160,000 gpd, respectively. In 1980 there were 1200 services, all metered (including the village of Browns); the average pumpage in 1981 was 328,800 gpd. The water is prechlorinated, treated with polyphosphate to keep iron in solution, fluoridated, zeolite softened, and postchlorinated.

Prior to the installation of the groundwater supply in October 1923, water was obtained from Bonpas Creek at Browns.

WELL NO. 1, finished in sand and gravel, was completed in November 1962 to a depth of 81.3 ft by the Heldt-Monroe Co., Evansville, Ind. The well is located about 0.6 mile northeast of Grayville in the Wabash River bottoms, approximately 2280 ft N and 2600 ft W of the SE corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is 372.6 ft.

A drillers log of Well No. 1 follows:

Strata	*Thickness (It)*	*Depth (It)*
Top soil	3	3
Muddy sand	9	12
Sand and gravel	69.3	81.3

A 10-in. diameter hole was drilled to a depth of 81.3 ft. The well is cased with 10-in. pipe from about 20 ft above original land surface to a depth of 61.2 ft and equipped with 21.2 ft (overall length) of 10-in. Johnson red brass screen. The screened section from top to bottom consists of 8 ft of No. 14 slot, 6.1 ft of No. 20 slot, and 6.1 ft of No. 40 slot.

A production test was conducted on November 6, 1962, by representatives of the driller, the city, the State Water Survey, and Hardman Engineers. After 4 hr of pumping at a rate of 250 gpm, the drawdown was 1.79 ft from a nonpumping water level of 11.50 ft below land surface. Fifty min after pumping was stopped, the water level had recovered to 12.02 ft.

A second production test using one observation well was conducted on January 17, 1963, by representatives of the city, the State Water Survey, and Hardman Engineers. After 2.5 hr of pumping at a rate of 180 gpm, the final drawdown was 0.9 ft from a nonpumping water level of 11.9 ft below land surface. On the basis of the production test data, it was estimated that this well should yield 250 gpm (360,000 gpd) on a long-term basis.

The pumping equipment presently installed is a 7-in. Johnston vertical turbine pump set at 47 ft, rated at 260 gpm, and powered by a 32-hp 1730 rpm Ford gasoline engine.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B013192) of a sample collected October 25, 1982, showed the water to have a hardness of 327 mg/1, total dissolved minerals of 403 mg/1, and an iron content of 0.53 mg/1.

WELL NO. 2, finished in sand and gravel, was completed in April 1963 to a depth of 42.8 ft by the Heldt-Monroe Co., Evansville, Ind. The well is located about 300 ft north of Well No. 1, approximately 2580 ft N and 2600 ft W of the SE corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is 370.7 ft.

A drillers log of Well No. 2 follows:

Strata	*Thickness (ft)*	*Depth (ft)*
Clay	9.6	9.6
Muddy sand	1	10.6
Sand	68.6	79
Shale	at	79

A 30-in. diameter hole was drilled to a depth of 16 ft and finished 26 in. in diameter from 16 to 42.8 ft. The well is cased with 30-in. pipe from about 17 ft above original land surface (4 ft above the wellhouse floor) to a depth of 16 ft, and 10-in. pipe from about 22 ft above original land surface to a depth of 27.3 ft followed by 15.5 ft of 10-in. No. 40 slot Johnson screen. The annulus between the bore hole and casing-screen assembly is filled with sand and concrete from 0 to 8 ft and with fine gravel (less than 1/3 in.) from 8 to 42.8 ft.

A production test using two observation wells was conducted on May 2-3, 1963, by representatives of the driller, the State Water Survey, and Hardman Engineers. After 22.5 hr of pumping at a rate of 197 gpm, the final drawdown was 3.06 ft from a nonpumping water level of 3.06 ft below land surface.

The pumping equipment presently installed is a 6-in. Myers submersible pump rated at 200 gpm, and powered by a 20-hp Myers electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19168) is for a water sample from the well collected April 25, 1978.

WELL NO. 2, LABORATORY NO. A19168

		mg/l	me/l			mg/l	me/l
Iron	Fe	0.34		Silica	SiO_2	13	
Manganese	Mn	0.10		Fluoride	F	0.1	0.00
Ammonium	NH_4	0.00	0.00	Boron	B	0.2	
Sodium	Na	7.0	0.30	Cyanide	CN	0.00	
Potassium	K	0.8	0.02	Nitrate	NO_3	10.6	0.17
Calcium	Ca	96.0	4.74	Chloride	CI	14	0.39
Magnesium	Mg	21.6	1.78	Sulfate	SO_4	65	1.14
				Alkalinity	(as $CaCO_3$)	266	6.12
Arsenic	As	0.000					
Barium	Ba	0.0		Hardness	(as $CaCO_3$)	326	6.52
Cadmium	Cd	0.00					
Chromium	Cr	0.00		Total dissolved			
Copper	Cu	0.00		minerals		380	
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0		pH (as rec'd)		7.7	

WELL NO. 3, finished in sand and gravel, was completed in July 1964 to a depth of 44 ft by the Heldt-Monroe Co., Evansville, Ind. This well is available for emergency use. The well is located about 7 ft west of Well No. 1, approximately 2280 ft N and 2607 ft W of the SE corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is approximately 372 ft.

A drillers log of Well No. 3 follows:

Strata	*Thickness (ft)*	*Depth (ft)*
Clay	2	2
Sand and gravel	42	44

A 30-in. diameter hole was drilled to a depth of 44 ft. The well is cased with 10-in. pipe from about 20.5 ft above original land surface (1 ft above built-up land surface) to a depth of 29 ft, followed by 15 ft of 10-in. No. 40 slot Johnson Everdur screen. The annulus between the bore hole and casing-screen assembly is filled with sand and concrete from about 15 ft above original land surface to a depth of 11.5 ft and with gravel from 11.5 to 44 ft.

A production test was conducted on July 8, 1964, by representatives of the driller, the State Water Survey, and Hardman Engineers. After 1.7 hr of pumping at a rate of 245 gpm, the drawdown was 3.57 ft from a non-pumping water level of 8.11 ft below land surface. Twenty min after pumping was stopped, the water level had recovered to 8.24 ft. On the basis of the production test data, it was estimated that this well should yield 400 gpm (576,000 gpd) on a long-term basis.

The pumping equipment presently installed is a 6-in. Myers submersible pump rated at 200 gpm at about 290 ft TDH, and powered by a 20-hp Myers electric motor.

A partial analysis of a sample (Lab. No. 163426) collected during the initial production test, after pumping for 1.5 hr at 245 gpm, showed the water to have a hardness of 338 mg/l, total dissolved minerals of 401 mg/l, and an iron content of 0.3 mg/l.

WELL NO. 4, finished in sand and gravel, was completed in August 1977 to a depth of 50 ft by the D. L. Little Drilling Co., New Harmony, Ind. The well is located approximately 2440 ft S and 2475 ft W of the NE corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is approximately 370 ft.

A drillers log of Well No. 4 follows:

Strata	*Thickness (ft)*	*Depth (ft)*
Clay	4	4
Muddy sand	2	6
Sand and gravel	44	60

A 34-in. diameter hole was drilled to a depth of 50 ft. The well is cased with 30-in. steel pipe from about 11 ft above land surface to a depth of 15 ft, and 12.8-in. OD pipe from about 12 ft above land surface to a depth of 35 ft followed by 15 ft of 12-in. No. 50 slot screen. The annulus between the bore hole and 30-in. casing is filled with concrete from 0 to 15 ft, and the annulus between the 30- and 12.8-in. casings and between the bore hole and casing-screen assembly is filled with concrete from the top of the casings to a depth of 15 ft and with Ohio No. 4 quartz gravel from 15 to 50 ft.

Upon completion, the well reportedly produced 500 gpm for 3 hr with a drawdown of 4 ft from a non-pumping water level of 9 ft below land surface.

The pumping equipment presently installed is a Myers submersible pump rated at 170 gpm, and powered by an electric motor.

ALLENDALE

The village of Allendale (613) installed a public water supply in 1949. Three wells (Nos. 1, 4, and 5) are in use and two wells (Nos. 2 and 3) are available for emergency use. In 1963 there were 203 services, all metered; the estimated average and maximum pumpages in 1955 were 20,000 and 40,000 gpd, respec-

lively. In 1980 there were 270 services, all metered; the average pumpage in 1981 was 36,000 gpd. The water is chlorinated and fluoridated.

WELL NO. 1, open to Pennsylvanian sandstone, was completed in August 1949 to a depth of 200 ft by E. L. Potts & Son, St. Francisville. The well is located in the southeast part of the village off Third St., approximately 150 ft N and 1000 ft W of the SE corner of Section 11, T1N, R12W. The land surface elevation at the well is approximately 492 ft.

A drillers log of Well No. 1 follows:

Strata	*Thickness (ft)*	*Depth (ft)*
Clay and soil	14	14
Sandstone (brown, broken)	6	19
Sa.ndst.one (gray, broken)	13	32
Slate (gray)	6	38
Coal	1	39
Slate (gray)	4	43
Slate (gray, soft)	3	46
Sandstone (hard)	4	50
Sandstone (broken)	9	69
Slate (dark)	40	99
Sandstone (hard)	4	103
Slate (gray, sandy)	3	106
Slate (gray)	37	143
Sandstone (broken)	7	150
Sandstone (light, water)	22	172
Sandstone (broken)	21	193
Slate (gray)	7	200

A 10-in. diameter hole was drilled to a depth of 150 ft and finished 8 in. in diameter from 150 to 200 ft. The well is cased with 8-in. steel pipe from about 1 ft above land surface to a depth of 150 ft.

A production test was conducted on September 28, 1949, by representatives of the driller, the village, the State Water Survey, and Paul J. Kleiser & Associates, Consulting Engineers. After 3.8 hr of pumping at rates of 25 to 15.6 gpm, the maximum drawdown was 84 ft from a nonpumping water level of 96 ft below the pump base. Pumping was continued for 43 min at rates of 13.6 to 12 gpm with a final drawdown of 61 ft. Twenty-seven min after pumping was stopped, the water level had recovered to 115 ft.

The pumping equipment presently installed is a Flint & Walling submersible pump set at 153 ft, rated at 10.5 gpm, and powered by a 2-hp Flint & Walling electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B018535) of a sample collected December 16, 1982, showed the water to have a hardness of 140 mg/1, total dissolved minerals of 486 mg/1, and an iron content of 0.09 mg/I.

WELL NO. 2, open to Pennsylvanian sandstone, was completed in October 1949 to a depth of 206 ft by E. L. Potts & Son, St. Francisville. This well is available for emergency use. The well is located on the west side of the village beneath the elevated storage tank, approximately 1350 ft N and 2750 ft W of the SE corner of Section 11, T1N, R12W. The land surface elevation at the well is approximately 495 ft.

A correlated drillers log of Well No. 2 furnished by the State Geological Survey follows:

Strata	*Thickness (ft)*	*Depth (ft)*
QUATERNARY SYSTEM		
Pleistocene Series		
Clay, soil	20	20
PENNSYLVANIAN SYSTEM		
Missourian Series		
Sandstone, broken	7	27
Sandstone, gray, broken	6	33
Slate, gray	8	41
Coal, shale, black	2	43
Slate, gray	7	60
Slate, light, sort	6	66
Limestone, broken	3	59
Slate, light	6	65
Limestone, broken	3	68
Slate, gray	9	77
Slate, dark	33	110
Slate, gray	11	121
Slate, gray, sort	5	126
Slate, light	17	143
Sandstone, broken	5	148
Sandstone, water	67	206
Limestone	1	206

A 10-in. diameter hole was drilled to a depth of 146 ft and finished 8 in. in diameter from 146 to 206 ft. The well is cased with 8-in. steel pipe from land surface to a depth of 146 ft.

A production test was conducted on October 19-20, 1949, by representatives of the village, the State Water Survey, and Paul J. Kleiser & Associates, Consulting Engineers. After 24 hr of pumping at rates ranging from 10.3 to 16.8 gpm, the final drawdown was 94 ft from a nonpumping water level of 91 ft below the pump base. Twenty-nine min after pumping was stopped, the water level had recovered to 121 ft.

The pumping equipment presently installed is a Flint & Walling submersible pump set at 157 ft, rated at 8 gpm, and powered by a 1-1/2-hp Flint & Walling electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B12943) of a sample collected September 13, 1978, after pumping for 4 hr at 6 gpm, showed the water to have a hardness of 54 mg/1, total dissolved minerals of 582 mg/1, and an iron content of 0.40 mg/1.

WELL NO. 3, open to Pennsylvanian sandstone, was completed in October 1949 to a depth of 170 ft by E. L. Potts & Son, St. Francisville. This well is available for emergency use. The well is located in the northwest part of the village about 3 blocks west of Illinois Route 1 off Oak St., approximately 2100 ft N and 2400 ft W of the SE corner of Section 11, T1N, R12W. The land surface elevation at the well is approximately 460 ft.

A drillers log of Well No. 3 follows:

Strata	Thickness (ft)	Depth (ft)
Clay and soil	15	15
Shale and sandstone	4	19
Slate (gray)	20	39
Slate (dark)	21	80
Limestone	2	62
Slate (gray)	26	88
Slate (light, muddy)	8	98
Slate (gray)	14	110
Sandstone (broken)	6	116
Sandstone (hard)	8	124
Sandstone (water)	44	168
Slate (dark)	2	170

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B17999) is for a water sample from the well collected October 7, 1980, after 2 hr of pumping at 8 gpm.

WELL NO. 3, LABORATORY NO. B17999

		mg/l	me/l			mg/l	me/l
Iron	Fe	0.41		Silica	SiO_2	19	
Manganese	Mn	0.018		Fluoride	F	0.32	0.02
Ammonium	NH_4	0.5	0.03	Boron	B	0.14	
Sodium	Na	210	9.14	Cyanide	CN	<0.005	
Potassium	K	2.63	0.07	Nitrate	NO_3	<0.4	
Calcium	Ca	17	0.85	Chloride	Cl	18	0.61
Magnesium	Mg	10	0.82	Sulfate	SO_4	5	0.10
Strontium	Sr	0.14		Alkalinity	(as $CaCO_3$)	600	10.00
Arsenic	As	<0.001		Hardness	(as $CaCO_3$)	79	1.58
Barium	Ba	0.26					
Beryllium	Be	<0.0005		Total dissolved			
Cadmium	Cd	<0.002		minerals		673	
Chromium	Cr	<0.002					
Cobalt	Co	<0.006					
Copper	Cu	<0.006					
Lead	Pb	<0.006					
Mercury	Hg	<0.00006					
Nickel	M	<0.005					
Selenium	Se	<0.001					
Silver	Ag	<0.006					
Vanadium	V	<0.005					
Zinc	Zn	0.008		pH (as rec'd)		7.4	

An 8-in. diameter hole was drilled to a depth of 130 ft and finished 6 in. in diameter from 130 to 170 ft. The well is cased with 8-in. steel pipe from about 1 ft above land surface to a depth of 116 ft.

A production test using one observation well was conducted on November 3-4, 1949, by representatives of the driller, the Heldt-Monroe Co., Evansville, Ind., the village, the State Water Survey, and Paul J. Kleiser & Associates, Consulting Engineers. After 19.7 hr of pumping at rates ranging from 14 to 10.3 gpm, the final drawdown was 78 ft from a nonpumping water level of 57 ft. The water level recovered to 65 ft after pumping had been stopped for 3.1 hr.

In 1970, the nonpumping water level was reported to be 72.5 ft.

The pumping equipment presently installed is a Flint & Walling submersible pump set at 141 ft, rated at 8 gpm, and powered by a l-l/2-hp Flint & Walling electric motor.

Using the data collected during the production tests of Wells 1, 2, and 3, a total yield of 15 gpm was estimated for their continuous use.

WELL NO. 4, open to Pennsylvanian sandstone, was completed in January 1950 to a depth of 170 ft by E. L. Potts & Son, St. Francisville. The well is located near First and Locust Sts., approximately 2010 ft N and 700 ft W of the SE corner of Section 11, T1N, R12W. The land surface elevation at the well is approximately 465 ft.

A drillers log of Well No. 4 follows:

Strata	Thickness (ft)	Depth (ft)
Clay and soil	21	21
Rock, shelly	3	24
Slate, gray	11	35
Slate, dark	8	43
Slate, gray	7	50
Slate, dark	8	58
Slate, gray	9	67
Limestone, hard	1	68
Slate, gray	44	112
Sandstone, broken	18	130
Sandstone (water)	40	170

A 6-in. diameter hole was drilled to a depth of 133 ft and finished 5 in. in diameter from 133 to 170 ft. The well is cased with 4-in. galvanized pipe from about 1 ft above land surface to a depth of 133 ft.

A production test was conducted on February 8, 1950, by representatives of the driller, the village, the State Water Survey, and Paul J. Kleiser & Associates, Consulting Engineers. After 2.5 hr of pumping at rates of 14.8 to 14.2 gpm, the drawdown was 69.5 ft from a nonpumping water level of 61.5 ft below land surface. Pumping was continued for 30 min at a rate of 12.5 gpm with a final drawdown of 60.5 ft. Five min after pumping was stopped, the water level had recovered to 77.0 ft.

The pumping equipment presently installed is a Flint & Walling submersible pump set at 141 ft, rated at 8 gpm, and powered by a 1-1/2-hp Flint & Walling electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A108719) of a sample collected January 3, 1974, after pumping for 2 hr at 8 gpm, showed the water to have a hardness of 170 mg/l, total dissolved minerals of 440 mg/l, and an iron content of 0.22 mg/l.

WELL NO. 5, open to Pennsylvanian sandstone, was completed in February 1950 to a depth of 170 ft by E. L. Potts fe Son, St. Francisville. The well is located at the northeast corner of the village at the end of Mulberry St., approximately 2270 ft N and 10 ft W of the SE corner of Section 11, T1N, R12W. The land surface elevation at the well is approximately 470 ft.

A drillers log of Well No. 5 follows:

Strata	Thickness (ft)	Depth (ft)
Clay and soil	18	16
Rock, sandy	4	20
Slate, gray	11	31
Slate, dark	29	60
Sandstone, hard	8	68
Slate, gray	44	112
Sandstone, broken	16	128
Sandstone (water)	40	168
Sandstone, hard	2	170

A 6-in. diameter hole was drilled to a depth of 130 ft and finished 5 in. in diameter from 130 to 170 ft. The well is cased with 5-in. ID pipe from about 1 ft above land surface to a depth of 130 ft.

A production test using one observation well (No. 4) was conducted on February 8, 1950, by representatives of the driller, the village, the State Water Survey, and Paul J. Kleiser & Associates, Consulting Engineers. After 4.5 hr of pumping at rates of 7.4 to 13.1 gpm, the final drawdown was 34.0 ft from a nonpumping water level of 65.5 ft below land surface. The water level recovered to 67.1 ft after pumping had been stopped for 2.6 hr.

The pumping equipment presently installed is a Flint & Walling submersible pump set at 141 ft, rated at 13 gpm, and powered by a 3-hp Flint & Walling electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B138135) is for a water sample from the well collected May 6, 1975, after 48 hr of pumping at 12 gpm.

WELL NO. 5, LABORATORY NO. B13813S

		mg/l	me/l			mg/l	me/l
Iron	Fe	0.5		Silica	SiO_2	26	
Manganese	Mn	0.0		Fluoride	F	0.4	0.02
Ammonium	NH_4	0.8	0.04	Boron	B	0.1	
Sodium	Na	74	3.22	Cyanide	CN	0.00	
Potassium	K	1.6	0.04	Nitrate	NO_3	0.6	0.01
Calcium	Ca	62	3.09	Chloride	Cl	6	0.17
Magnesium	Mg	27	2.22	Sulfate	SO_4	0	0.00
				Alkalinity	(as $CaCO_3$)	421	8.42
Arsenic	As	0.000					
Barium	Ba	0.6		Hardness	(as $CaCO_3$)	266	6.32
Cadmium	Cd	0.00					
Chromium	Cr	0.00		Total dissolved			
Copper	Cu	0.04		minerals		463	
Lead	Pb	0.00		pH (as	rec'd)	7.6	
Mercury	Hg	0.0000		Radioactivity			
Nickel	Ni	0.0		Alpha [	pc/l]	6.2	
Selenium	Se	0.000		± deviation		2.1	
Silver	Ag	0.000		Beta [pc/1]		8.4	
Zinc	Zn	0.0		± deviation		2.1	

BELLMONT

The village of Bellmont (307) installed a public water supply in 1956. Two wells (Nos. 1 and 3) are in use. In 1957 there were 60 services; the estimated average and maximum pumpages were 8000 and 10,000 gpd, respectively. In 1981 there were 160 services, all metered; the average pumpage was 29,900 gpd. The water is chlorinated.

WELL NO. 1, open to Pennsylvanian sandstone, was completed in September 1954 to a depth of 346 ft by the Heldt-Monroe Co., Evansville, Ind. The well is located adjacent to the elevated tank, approximately 2000 ft N and 1800 ft E of the SW corner of Section 31, T1S, R13W. The land surface elevation at the well is approximately 440 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

Strata	Thickness (ft)	Depth (ft)
QUATERNARY SYSTEM		
Pleistocene Series		
Soil	3	3
Clay	10	13
PENNSYLVANIAN SYSTEM		
Missourian Series		
Soapstone	40	63
Sand rock	8	61
Soapstone	20	81
Coal	4	85
Soapstone	1	88
Lime	3	89
Soapstone	23	112
Sand rock	24	136
Soapstone	21	157
Shale	3	160
Soapstone	9	189
Lime	6	174
Soapstone	88	282
Sand rock	82	344
Soapstone	2	348

Originally, the well was cased with 8-in. steel pipe from about 3 ft above land surface to a depth of 270 ft. In March 1980, a 6.6-in. steel casing was placed to a depth of 264 ft (cemented in).

A production test was conducted on October 4-5, 1954, by representatives of the driller, the village, the State Water Survey, and Marbry and Johnson, Consulting Engineers. After 27.2 hr of pumping at rates of 35.6 to 22.0 gpm, the final drawdown was 255 ft from a nonpumping water level of 64 ft below land surface. Thirty-two min after pumping was stopped, the water level had recovered to 160 ft.

In October 1978, after a new pump had been installed, this well produced mostly air and the production capacity decreased drastically. This well was not used until it was examined and repaired in March 1980, and then a new casing was installed.

The pumping equipment presently installed is a Jacuzzi submersible pump (No. 3HPS4B48B) rated at 12 gpm at about 400 ft TDH, and powered by a 3-hp Franklin electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B10003) of a sample collected September 4, 1975, after pumping for 8 hr at about 16 gpm, showed the water to have a hardness of 2 mg/1, total dissolved minerals of 689 mg/1, and an iron content of 0.0 mg/1.

WELL NO. 2 (former Bellmont Grade School well), open to Pennsylvanian sandstone, was completed in 1950 to a depth of 350 ft. This well, privately owned and not used by the village since 1977, has been disconnected from the village system. The well is located about 100 yards northeast of the Bellmont Grade School, approximately 1560 ft N and 2620 ft W of the SE corner of Section 31, T1S, R13W. The land surface elevation at the well is approximately 450 ft.

The well is cased with 8-in. steel pipe from about 1.5 ft above land surface to a depth of 200 ft.

The pumping equipment presently installed is a Fairbanks Morse submersible pump rated at 35 gpm, and powered by a 5-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B019264) is for a water sample from the well collected December 28, 1982.

WELL NO. 2, LABORATORY NO. B019264

		mg/l	*me/l*			*mg/l*	*me/l*
Iron	Fe	0.01		Silica	SiO_2	7.4	
Manganese	Mn	<0.005		Fluoride	F	1.08	0.08
Ammonium	NH_4	0.3	0.02	Boron	B	0.34	
Sodium	Na	307	13.36	Cyanide	CN	<0.005	
Potassium	K	0.82	0.02	Nitrate	NO_3	<0.4	
Calcium	Ca	1	0.05	Chloride	CI	71	2.00
Magnesium	Mg	0.7	0.08	Sulfate	SO_4	<10	
Strontium	Sr	0.026		Alkalinity	(as $CaCO_3$)	660	11.20
Arsenic	As	<0.001		Hardness	(as $CaCO_3$)	<10	
Barium	Ba	0.009					
Beryllium	Be	<0.0006		Total dissolved			
Cadmium	Cd	<0.003		minerals		730	
Chromium	Cr	<0.006					
Cobalt	Co	<0.006					
Copper	Cu	<0.003					
Lead	Pb	<0.006					
Mercury	Hg	<0.00006					
Nickel	Ni	<0.003					
Selenium	Se	0.001					
Silver	Ag	<0.006					
Vanadium	V	<0.004					
Zinc	Zn	<0.002		pH (as rec'd)		8.8	

WELL NO. 3, open to Pennsylvanian sandstone, was completed in August 1976 to a depth of 335 ft by Olen L. Wilson, Fairfield. The well is located within the business district on lot 9, block F, approximately 1990 ft N and 100 ft W of the SE corner of Section 36, T1S, R14W. The land surface elevation at the well is approximately 421 ft.

A drillers log of Well No. 3 follows:

Strata	*Thickness (ft)*	*Depth (ft)*
Yellow clay	18	18
Blue clay	7	25
Sandstone	16	40
Sandy shale	6	46
Shale	6	50
Dark shale	8	58
Coal	1	59
Shale	3	62
Limey sandstone	18	80
Shale	13	93
Coal	2	95
Shale	3	98
Limestone	2	100
Sandy shale	8	108
Shale	3	111
Coal	1	112
Shale	14	126
Sandstone	39	165
Shale	19	184
Slate	2	188
Limey sandstone	18	204
Shale	32	238
Slate	2	238
Shale	22	260
Sandstone	70	330
Shale	6	336

The well is cased with 8.6-in. OD steel pipe from about 2 ft above land surface to a depth of 30.5 ft (cemented in to 28 ft) and 5.6-in. OD steel pipe from about 2 ft above land surface to a depth of 279 ft. Below the casing, the hole was finished 6 in. in diameter to the bottom.

Upon completion, the well reportedly produced 10 gpm for 3 hr with a drawdown of 75 ft from a non-pumping water level of 73 ft below land surface.

The pumping equipment presently installed is a Valley submersible pump set at 320.2 ft, rated at 38 gpm at about 400 ft TDH, and powered by a 7-1/2-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A22070) is for a water sample from the well collected May 5, 1977, after 30 min of pumping.

WELL NO. 3, LABORATORY NO. A22070

		mg/l	*me/l*			*mg/l*	*me/l*
Iron	Fe	2.4		Silica	SiO_2	16	
Manganese	Mn	0.02		Fluoride	F	0.7	0.04
Ammonium	NH_4	0.19	0.01	Boron	B	1.0	
Sodium	Na	135	5.87	Nitrate	NO_3	12.4	0.20
Potassium	K	1.5	0.04	Chloride	CI	71	2.00
Calcium	Ca	66	3.29	Sulfate	SO_4	65	1.14
Magnesium	Mg	34	2.80	Alkalinity	(as $CaCO_3$)	480	9.20
Arsenic	As	0.000		Hardness	(as $CaCO_3$)	310	6.20
Barium	Ba	0.1					
Cadmium	Cd	0.00		Total dissolved			
Chromium	Cr	0.00		minerals		890	
Copper	Cu	0.00					
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.00					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	1.0		pH (as rec'd)		7.4	

GRAYVILLE

The city of Grayville (2313) installed a public water supply in 1895. A portion of this city extends into White County but the wells are located in Wabash County. Three wells are in use. In 1981 there were 1014 services, all metered; the estimated average and maximum pumpages were 375,000 and 425,000 gpd, respectively. The water is fluoridated and chlorinated.

Prior to the installation of the groundwater supply in 1928, water was obtained from the Wabash River.

WELL NO. 1, finished in sand and gravel, was completed in 1927 to a depth of 67.9 ft below original land surface by the Thorpe Concrete Well Co., Alton. The well is located about 0.2 mile east of the city in the Wabash River bottoms, approximately 834 ft N and 2140 ft E of the SW corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is approximately 375 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

Strata	*Thickness (ft)*	*Depth (It)*
QUATERNARY SYSTEM		
Pleistocene Series		
Soil and silt	14	14
Sand	66	69
Gravel and sand	3.6	72.6

Originally, the well was cased with 26-in. ID by 36-in. OD concrete pipe from about 2 ft above original land surface (about 12 ft below the pumphouse floor) to a depth of 13 ft. A porous concrete screen of the same size extended from 13 to 67.9 ft. A 6-in. protective steel casing was placed from about 14 ft above original land surface to 2 ft above original land surface. In April 1980, this well was rehabilitated by the D. L. Little Drilling Co., New Harmony, Ind. The well was then cased with 10-in. ID steel pipe from about 14 ft above original land surface to a depth of 52.9 ft followed by 15 ft of 10-in. Cook stainless steel screen. The annulus between the old concrete casing and the new steel casing is filled with gravel pack and sealed with cement at land surface.

A production test was conducted by the Caldwell Engineering Co. in 1927. After pumping for 15 hr at a rate of 377 gpm, the drawdown was 3.6 ft from a nonpumping water level of 9.2 ft below the top of the casing.

In 1942, it was reported that the pump had not been operated in over a year, and that the pump had broken suction a short time after starting. The porous concrete screen was reported to be badly clogged.

A production test was conducted by Warren & Van Praag, Consulting Engineers, on December 12, 1944. After 2.9 hr of pumping at a rate of 300 gpm, the drawdown was greater than 46.5 ft from a nonpumping water level of 17.0 ft below land surface.

December 21, 1944, after the well had broken suction within 10 min, Dowell, Inc., treated this well with 500 gal of HC1. After treatment the production capacity was estimated to be about 265 gpm with a drawdown of 3.5 ft.

In March 1969, the well was cleaned and acidized by the D. L. Little Drilling Co., and the well was reported to produce 312 gpm after treatment.

In 1974, the well was cleaned by the D. L. Little Drilling Co. After cleaning, the well was reported to produce 350 to 380 gpm.

In August 1982, E. C. Baker & Sons, Inc., Sigel, reportedly removed 6 in. of sand from the bottom of the well. The well depth was measured to be 79.2 ft from the top of the concrete well curb.

The pumping equipment presently installed is a Sta-Rite submersible pump (Model No. 300R803B) set at 66 ft below original land surface, rated at about 300 gpm, and powered by a 30-hp Franklin electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B29902) of a sample collected December 15, 1980, after pumping for 2.5 hr, showed the water to have a hardness of 349 mg/l, total dissolved minerals of 396 mg/1, and an iron content of 0.52 mg/1.

WELL NO. 2, finished in sand and gravel, was completed in 1927 to a depth of 71.8 ft below original land surface by the Thorpe Concrete Well Co., Alton. The well is located about 80 ft east of Well No. 1, approximately 834 ft N and 2200 ft E of the SW corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is approximately 375 ft.

Originally, the well was cased with 26-in. ID by 36-in. OD concrete pipe from about 14 ft above original land surface (pumphouse floor level) to a depth of 16.8 ft. A porous concrete screen of the same size extended from 16.8 to 71.8 ft. In July 1979, the well was cased with 12.8-in. pipe from the pumphouse floor to a depth of 56.8 ft, followed by 15 ft of 12.8-in. No. 50 slot Cook stainless steel screen. The annulus between the old concrete casing and the new 12.8-in. casing is filled with 20 ft of cement followed by gravel pack.

A production test was conducted by the Caldwell Engineering Co. on October 19, 1927. After 12 hr of pumping at an average rate of 502 gpm, the drawdown was 5.8 ft from a nonpumping water level of 9.3 ft below the top of the casing.

A production test was conducted by Warren & Van Praag, Consulting Engineers, on December 13, 1944. The well reportedly produced 320 gpm for 0.9 hr with a drawdown of 24 ft from a nonpumping water level of 17 ft below land surface.

In July 1979, this well was rehabilitated by the D. L. Little Drilling Co., New Harmony, Ind. The well was acidized with 25 lb of HTH granular chlorine, and new casing and screen were installed.

The pumping equipment presently installed is a Sta-Rite submersible pump (Model No. 300R803B) set at 62 ft below original land surface, rated at about 300 gpm, and powered by a 30-hp Franklin electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B29136) of a sample collected January 11, 1979, after pumping for 4 hr, showed the water to have a hardness of 363 mg/1, total dissolved minerals of 392 mg/1, and an iron content of 0.27 mg/1.

WELL NO. 3, finished in sand and gravel, was completed in 1941 to a depth of 73 ft below original land surface by the Thorpe Concrete Well Co., Alton. The well is located about 80 ft south of Well No. 2, approximately 754 ft N and 2220 ft E of the SW corner of Section 16, T3S, R14W, Wabash County. The land surface elevation at the well is approximately 375 ft.

A drillers log of Well No. 3 follows:

Strata	*Thickness (ft)*	*Depth (ft)*
Clay	6	6
Sand, fine, yellow	10	16
Sand, fine	10	26
Building sand	6	30
Sand, fine, yellow	6	S6
Sand, fine gray	29	64
Sand, coarse	8	70
Sand, coarse and gravel, fine with lignite	4	74

Originally, the well was cased with 26-in. ID by 36-in. OD concrete pipe from about 12 ft above original land surface (2 ft below the pump base) to a depth of 18 ft. A porous concrete screen of the same size extends from 18 to 73 ft. The well is enclosed in concrete to a height of about 15 ft above land surface. In July 1978, this well was rehabilitated by the D. L. Little Drilling Co., New Harmony, Ind. The well was then cased with 68.5 ft of 12.8-in. OD steel pipe followed by 15 ft of 12-in. No. 50 slot Cook stainless steel screen.

A production test was conducted by Warren & Van Praag, Consulting Engineers, on December 12, 1944. After 1.2 hr of pumping at a rate of 264 gpm, the drawdown was 2.5 ft from a nonpumping water level of 31.0 ft below the pumphouse floor.

In March 1969, the well was cleaned and acidized by the D. L. Little Drilling Co. Results of this acidizing are not available.

In 1974, the well was cleaned by the D. L. Little Drilling Co., and the well was reported to produce 350 gpm after the cleaning.

The pumping equipment presently installed is a Reda submersible pump set at 56 ft below original land surface, rated at 300 gpm, and powered by a 30-hp Reda electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B30304) is for a water sample from the well collected December 16, 1980, after 2 hr of pumping.

WELL NO. 3, LABORATORY NO. B30304

		mg/l	*me/l*		*mg/l*	*me/l*
Iron	Fe	0.23		Silica	SiO_2 13	
Manganese	Mn	0.18		Fluoride	F 0.17	0.01
Ammonium	NH_4	<0.1		Boron	B 0.02	
Sodium	Na	6	0.28	Cyanide	CN 0.01	
Potassium	K	0.8	0.02	Nitrate	NO_3 2.6	0.04
Calcium	Ca	98	4.89	Chloride	Cl 11	0.31
Magnesium	Mg	26	2.08	Sulfate	SO_4 63	1.10
Strontium	Sr	0.11		Alkalinity	(as $CaCO_3$) 304	6.08
Arsenic	As	<0.001		Hardness	(as $CaCO_3$) 367	7.14
Barium	Ba	0.06				
Beryllium	Be	<0.0002		Total dissolved		
Cadmium	Cd	<0.002		minerals	394	
Chromium	Cr	<0.002				
Cobalt	Co	<0.002				
Copper	Cu	<0.002				
Lead	Pb	0.006				
Mercury	Hg	<0.00005				
Nickel	Mi	<0.002				
Selenium	Se	0.001				
Silver	Ag	<0.002				
Vanadium	V	<0.002				
Zinc	Zn	0.068		pH (as rec'd)	7.1	

KEENSBURG

The village of Keensburg (244) installed a public water supply in 1958. One well is in use. In 1960 there were 48 services, all metered; the estimated average pumpage was 3000 gpd. In 1982 there were 115 services, all metered; the average pumpage in 1981 was 15,000 gpd. The water is aerated, filtered, fluoridated, and chlorinated.

Prior to the construction of a public water supply, seven test holes were constructed to depths ranging

from 28 to 65 ft. They were located in Sections 16 and 21, T2S, R13W.

WELL NO. 1, finished in sand and gravel, was completed in September 1958 to a depth of 50 ft by the T & H Pump & Equipment Co., Evansville, Ind. Water from this well is discharged through a pipeline to the village. This well is owned by the M & M Oil Co., Albion, and is primarily used for oil field flooding. The well is located about 0.8 mile southeast of the village, approximately 675 ft N and 1650 ft W of the SE corner of Section 16, T2S, R13W. The land surface elevation at the well is approximately 386 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

Strata	*Thickness (ft)*	*Depth (ft)*
QUATERNARY SYSTEM		
Pleistocene Series		
"Overlay"	8	8
"Sand and graver	12	20
"Coarse sand and gravel"	10	30
"Sand and graver	10	40
"Sand and gravel, finer"	10	60

A 12-in. diameter hole was drilled to a depth of 50 ft. The well is cased with 12-in. steel pipe from about 1 ft above the pumphouse floor to a depth of 25 ft, followed by 25 ft of 12-in. Cook brass screen. The screened section from top to bottom consists of 5 ft of No. 100 slot, 10 ft of No. 35 slot, and 10 ft of No. 25 slot.

A production test was conducted on April 29, 1959, by representatives of the village, the State Water Survey, and the Barger Engineering Co. After 3 hr of pumping at a rate of 100 gpm, the drawdown was 1.19 ft from a nonpumping water level of 5.72 ft.

The pumping equipment presently installed is a submersible pump operated at 60 gpm, and powered by an electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A105912) is for a water sample from the well collected October 1, 1974, after 5 hr of pumping.

WELL NO. 1, LABORATORY NO. A105912

		mg/l	*me/l*		*mg/l*	*me/l*
Iron	Fe	0.37		Silica	SiO_2 17	
Manganese	Ma	0.10		Fluoride	F 0.2	0.01
Ammonium	NH_4	0.4	0.02	Boron	B 0.0	
Sodium	Na	17.2	0.76	Cyanide	CN 0.000	
Potassium	K	1.0	0.03	Nitrate	NO_3 0.0	0.00
Calcium	Ca	84.6	4.22	Chloride	Cl 67	1.89
Magnesium	Mg	31.6	2.69	Sulfate	SO_4 66	1.36
				Alkalinity	(as $CaOO_3$) 210	4.20
Arsenic	As	0.00				
Barium	Ba	0.0		Hardness	(as $CaCO_3$) 340	6.80
Cadmium	Cd	0.00				
Chromium	Cr	0.00		Total dissolved minerals	410	
Copper	Cu	0.00		pH (as rec'd)	8.1	
Lead	Pb	0.00		Radioactivity		
Mercury	Hg	0.0000		Alpha [pc/1]	0.0	
Nickel	Ni	0.0		± deviation	0.0	
Selenium	Se	0.00		Beta [pc/1]	0.4	
Silver	Ag	0.00		± deviation	1.5	
Zinc	Zn	0.0				